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MOBILE TELEVISION RADIO LINK(U) FOREIGN TECHNOLOGY DIV
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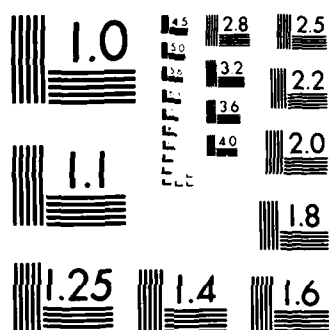
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MOBILE TELEVISION RADIO LINK

by

V.N. Vinogradov, G.V. Yablokov



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EDITED TRANSLATION

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MOBILE TELEVISION RADIO LINK

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TRANSLATION DIVISION
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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	<i>А а</i>	A, a	Р р	<i>Р р</i>	R, r
Б б	<i>Б б</i>	B, b	С с	<i>С с</i>	S, s
В в	<i>В в</i>	V, v	Т т	<i>Т т</i>	T, t
Г г	<i>Г г</i>	G, g	У у	<i>У у</i>	U, u
Д д	<i>Д д</i>	D, d	Ф ф	<i>Ф ф</i>	F, f
Е е	<i>Е е</i>	Ye, ye; E, e*	Х х	<i>Х х</i>	Kh, kh
Ж ж	<i>Ж ж</i>	Zh, zh	Ц ц	<i>Ц ц</i>	Ts, ts
З з	<i>З з</i>	Z, z	Ч ч	<i>Ч ч</i>	Ch, ch
И и	<i>И и</i>	I, i	Ш ш	<i>Ш ш</i>	Sh, sh
Й й	<i>Й й</i>	Y, y	Щ щ	<i>Щ щ</i>	Shch, shch
К к	<i>К к</i>	K, k	Ъ ъ	<i>Ъ ъ</i>	"
Л л	<i>Л л</i>	L, l	Ы ы	<i>Ы ы</i>	Y, y
М м	<i>М м</i>	M, m	Ь ь	<i>Ь ь</i>	'
Н н	<i>Н н</i>	N, n	Э э	<i>Э э</i>	E, e
О о	<i>О о</i>	O, o	Ю ю	<i>Ю ю</i>	Yu, yu
П п	<i>П п</i>	P, p	Я я	<i>Я я</i>	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ë in Russian, transliterate as yë or ë.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	sinh ⁻¹
cos	cos	ch	cosh	arc ch	cosh ⁻¹
tg	tan	th	tanh	arc th	tanh ⁻¹
ctg	cot	cth	coth	arc cth	coth ⁻¹
sec	sec	sch	sech	arc sch	sech ⁻¹
cosec	csc	csch	csch	arc csch	csch ⁻¹

Russian English

rot curl
lg log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

MOBILE TELEVISION RADIO LINK

V. N. Vinogradov, G. V. Yablokov, engineers

New Equipment Serves the Five-year Plan

The new radio link is intended for the transmission of signals of a television image (black-white and color) and a two-program sound accompaniment. The radio link can be used both during operation with mobile television stations and with the fixed variant (SRL-11). This is necessary, for example, for the transmission of signals of television and sound accompaniment in the case of a separated variant of the television center (the ASK and RPS are located at separate sites); for the transmission of signals to television relays by means of branching from the radio-relay main line; for television relay points (from theaters, palaces, concert halls, videotelephones, etc.).

The equipment of the radio link ensures the steady transmission of signals for a distance up to 50 km without an intermediate relay at any time of the year and day with the compulsory absence of obstacles in the Fresnel zone and a power of 1 W for the radio transmitter.

The equipment of the radio link operates in the frequency ranges of 7550-7750 and 8500-8700 MHz, in which 10 radio channels are found. The number of radio links operating simultaneously is six. The radio transmitters of the radio link can be removed up to a distance of 300 m from the transmitter control and power supply units.

The upper receivers can be separated from the lower receivers by a distance up to 400 m.

The ratio of the peak-to-peak separation of the video signal to the effective voltage of noise on the output of the radio link, taking crossed interferences into account, is of an order of 60 dB. The ratio of the peak-to-peak separation of the video signal, not including the synchronizing pulses, to the peak-to-peak separation of periodic interference of a frequency of 50 Hz is of an order of 40 dB. The ratio of effective value of voltage of the signals of sound accompaniment to the effective voltage of psophometric noise and crossed interferences is no less than 60 dB.

Subcarrier frequencies of sound accompaniment: 7740 MHz \pm 16 kHz and 8140 MHz \pm 16 kHz.

The following signals are on the output of the radio link:

a) composite signal of positive polarity with a peak-to-peak separation of 1 V on a load of 75 ohms (3 outputs - 1 main and 2 control) with extremes of adjustment of voltage of the operating output of ± 7 dB;

b) voltage of the signal of sound accompaniment 5.5 V eff on a load of 600 ohms with two outputs for each program (1 operating, 1 control).

The stability of the carrier frequency of the transmitter - no worse than $\pm 0.03\%$ for 3 hours from the moment of setting of frequency and warm-up of the transmitter and no worse than $\pm 0.05\%$ during multi-hour continuous operation, and together with the AFC circuit of the receiver ensures the operation of the equipment without tuning.

The equipment normally operates in the temperature range of air from $+5$ to $+40^{\circ}\text{C}$ with a relative humidity up to 90%, measured at a temperature of $+25^{\circ}\text{C}$, for units which are found in accommodations, or equipment located in buses, and for remote equipment from -40 to $+55^{\circ}\text{C}$ with a relative humidity of 95% at a temperature of $\pm 35^{\circ}\text{C}$.

The equipment can operate normally for 12 hours continuously in the transport variant (PTS) and 18 hours in the fixed variant. The time for warm-up of the equipment for normal operation is no more than 25 min.

Radio Link (SRL-11) in a Fixed Version

The equipment for the fixed radio link ensures steady transmission and reception of signals for a distance up to 50 km (without an intermediate relay). The average power of the SRL-11 transmitter is 1 W. The fixed link operates on one of 10 channels in the frequency ranges of 7550-7750 MHz and 8500-8700 MHz.

In the case of the simultaneous operation of several radio links at one receiving point, in order to avoid mutual interferences the channels are selected every other one. The maximum number of simultaneously operating radio links in this case does not exceed six.

In the fixed SRL-11 radio link there are two transmitting and two receiving channels, one of which is main, the other is reserve. Both transmitters are found in the warm state, but generation on one of them is disrupted and the signal from this transmitter does not enter the air.

On the receiving end both receivers receive the signals from the transmitter simultaneously. With the help of the PU-436 commutation panel, located on the control panel in the receiving control room of the radio link, signals from one of the receivers are supplied to the usw transmitter.

All the equipment of transmitting control room is subdivided into outlying, located on a support (pole, tower or roof of a tall building), and equipment, located in the accommodation of the transmitting control room.

The composition of the main equipment of the transmitting section of the radio link includes: two transmitting antenna devices with parabolic reflectors and feeders; two radio transmitters; two units for control of the transmitters; two power supply units for the transmitters; a transmitting panel with the main units, video control devices, an oscillograph and a switching panel; a board for the input cables of the transmitting control room and a distributing board.

The auxiliary equipment consists of two video-control devices of the VK-150 type with kinescope dimensions of 23 cm on the diagonal (for black-white television), which are installed in the transmitting panel of the radio link; a type S1-52 oscillograph; a sound control

aggregate; a calling device; test line generator; telephone concentrator of the KD-6 type; one set of connecting cables; one set of spare equipment and a TA-57 telephone.

A specially developed reflecting klystron is used as the source of hf oscillations in the transmitters of the radio link.

The receiving control room of the SRL-11 radio link is intended for the reception of signals of the television signal and two programs of sound accompaniment, emitted by the transmitting side.

The equipment of the receiving control room is subdivided into outlying, located on a support (pole, tower, roof of a tall building), and equipment, located in the accommodation of the receiving control room.

The main equipment of the receiving side includes two receiving antenna devices with parabolic reflectors and feeders; two upper receivers and two lower receivers; two units for power supply of the receiving device; two panels for the receiving control room with the main units, video-control devices, oscillograph and switching panel; a board for input cables of the receiving control room and a distributing board.

The auxiliary equipment consists of two video-control devices of the VK-150 type, installed in the receiving panel of the radio link; a type S1-52 oscillograph; a sound control aggregate; a calling device; KD-6 telephone concentrator; TA-57 telephone unit; one set of connecting cables and one set of spare equipment.

Antennas for the Radio Link

The antennas of the radio link serve for the directional emission and reception of high-frequency signals of the image and sound accompaniment. On the transmitting and receiving sides of the fixed SRL-11 radio link antenna devices which are made structurally the same are used. They consist of parabolic reflectors 1.5 m in diameter and waveguide feeders, located in the focus of the reflectors. The feeders are connected with the upper (antenna) units of the radio link by waveguide circuits.

The antenna units are mounted in the pedestals of the antenna devices, which have a manual mechanism for the one-time aiming of the

antennas in the process of setting up the equipment.

The parabolic reflectors are made from several layers of fiber glass fabric, impregnated with a special resin. For increasing the strength of the parabola rigidity ribs are shaped on it. Metallized fabric of the SMM type is used as the reflecting surface.

Radio Link for Mobile Television Stations

The radio link for the mobile television stations uses the same main equipment as its fixed SEL-11 variant.

In this modification its transmitting section is situated in a mobile television station of the PTS-4 type with the antennas and radio transmitters removed or on the roof of a bus - the control-room vehicle or on a building which is located nearby (up to 300 m based on the length of the cable).

On the transmitting side of the radio link parabolic reflectors with an aperture diameter of 1.5 and 1.0 m and horn antennas are used (depending on the range required). It provides a range of operation of the radio link of up to 50 km. In the case of distances up to 10-15 km a parabola with a diameter of 1 m is used. During operation at lesser distances (up to 5 km) a horn antenna is used.

In the fixed receiving control room of this radio link three antenna devices are situated on its tower. Their construction is close to the construction of the antenna devices for the SRL-11 radio link. However, for realization of mechanical aiming of antennas on the mobile television station in the antenna device [they] have included an antenna control unit, the remote directioning of which on azimuth and angle of elevation is realized from the control panel of the receiving control room.

For maintaining the assigned temperature in the antenna devices and facilitating the directing of the antennas in the winter and hot periods of the year heating and ventilation systems are provided in them.

On the receiving side of the radio link two channels of the radio link operate simultaneously. As selected by the engineer of the receiving control room the signals of the image and the sound accompaniment of one of the two channels are directed to the central

control room of the radio transmitting station for modulation of the television and sound radio transmitters.

The selection and switching of two of the three antenna devices and the three upper receivers on the two lower receivers are realized on the board of input cables of the fixed receiving control room prior to the beginning of transmission.

Retransmitter

The retransmitter is an active mobile receiving-transmitting station, intended for the retransmission of the signal of the television image and two programs of sound accompaniment.

The main purpose of the retransmitter is supporting the operation of mobile television stations (PTS) in the case of the absence of direct visibility between the antennas of the mobile television station and the fixed receiving control room (SPA), and also for increasing the operating range of the PTS.

The complex of equipment of the television radio link which has been developed provides the capability of operation of two retransmitters (three spans of the radio link) in the case of a certain deterioration of the parameters of the transmitted signal. The layout of the retransmitter makes it possible to realize its rapid deployment with the raising of the receiving and transmitting antennas to a height of 30 m.



Retransmitter in an assembled form, ready for transit.



Retransmitter in a deployed form.

The retransmitter consists of a control room, located in a PAZ-672 bus, a mobile antenna support, representing a self-propelled rapidly deployable installation, with an independent ESB-12 power-supply aggregate, mounted on a single-axial vehicle trailer, for power supply of the retransmitter equipment in the event there is no electric power supply at the site.

The composition of the equipment of the retransmitter makes it possible to use it in several variants.

- A retransmitter with a mobile antenna-mast device (AMU).
- A retransmitter with installation of the outlying equipment on the roof of buildings which are located nearby (removed from the equipment vehicle up to 120 m based on the length of the cable) or directly on the roof of the equipment vehicle.
- The retransmitter can be used as a mobile receiving control room (PPA) at radio-television centers, where there is no mobile television station (PTS) and receiving control room for it, and also in the case when the PTS existing at the radio-television center cannot handle the volume of work in respect to outside television broadcasting due to the limited number of receiving channels. Such a use of the retransmitter together with the PTS virtually solves the problem of

television broadcasting outside of the studio in all the cities and major populated points when it becomes necessary to carry out such transmissions.

- The retransmitter can be used as a receiving control room for feeding of programs into the main-line RRL on terminal (main) points of the main-line RRL.

The retransmitter can also serve as a mobile transmitting control room for feeding (branching) of a program from an intermediate point of the main-line RRL, and also in the case of the necessity of carrying out outside transmission from a point which is located outside the zone of direct visibility on the SPA.

When the antenna mast device is used the antennas of the retransmitter and the upper units of the transmitter are installed on the antenna head of the AMU and raised to a height of up to 30 m. The AMU is a welded telescopic mast, situated on a vehicle chassis.

Structurally the AMU consists of the following main units and systems: the ZIL-131 chassis, telescopic mast, hydrobond jack; platform with outriggers, cable winding mechanism, antenna head; hydraulic system; auxiliary devices and mechanisms.

The mast is a telescopic construction, consisting of five sections, inserted one into the other. The sections have a three-sided cross section.

The antenna-mast device is intended for operation without additional guy lines (using only the outriggers) at wind speeds up to 12 m/s. The maximum wind speed for which the AMU is calculated when two tiers of guy lines are used is 30 m/s. With the total play of the AMU, with a calculation of the angle of twisting at the maximum permissible wind speed of 30 m/s, the reception and transmission of signals of the television image and two programs of sound accompaniment with assigned parameters are ensured.

For remote orientation of the antennas of the receivers and transmitters and the control antenna out in the air there is a unit for antenna control with position indicators for the receiving and transmitting antennas. For controlling the quality of operation of the radio link during transmission the equipment of the retransmitter includes a test line generator. For checking the program "big air"

["bol'shoy efir"] the equipment vehicle has been provided with a "Yunost'" television receiver.

The retransmitter is calculated for power supply from one or two (operational switching in the case of a loss of power supply voltages) networks of alternating current with a voltage of 220/380 V, frequency of 50 Hz. The retransmitter set includes an independent source of electric power in the form of a gasoline electrical aggregate of the ESB-12-1/230 type, located on the vehicle trailer. Power of the aggregate - 12 kW, voltage (line) - 230 V \pm 1% with a steady load in the limits of 25-100% of rated. Weight of the aggregate - 1500 kg.

For convenience of operation of service personnel the equipment vehicle is provided with a working cabin and a cabin for rest with 2-3 sleeping sites.

In the working cabin during the warm time of the year an air conditioner is used, and during cold - electric heaters. There is a refrigerator for storage of food products. The area around the bus can be illuminated with the two rotatable vehicle headlights.

Link between operators is realized with the help of a radio set for operator link-up. It operates in the decimeter wave range. The radio set makes it possible to establish two-way communication, both when operating at a halt and on the move.

For telephone communication in the process of operation the KD-6 telephone concentrator is used. It makes it possible to communicate with the mast operator [machtovik], the mobile television station (PTS) and the fixed receiving control room (SPA) (in the case of the possibility of crossing telephone pairs on the retransmitter).

Switching of the equipment from channel to channel and switching of the videocontrol devices of the VK-150 type, the oscillograph and the sound control aggregate are realized on the retransmitter switching unit.

The electrical equipment of the retransmitter bus includes power transformers, two network voltage stabilizers and a power supply rack, on which the switching on and off of all the power circuits of the retransmitter is carried out. All the outlying equipment, cables and ZIP are transported in the bus.

The maximum consumption of electric power by the retransmitter for a prolonged period of time comprises an order of 8 kW, minimal -

5 kW. Power supply voltage from a three-phase network - 380/220 V + 10-15%.

For protection of servicing personnel from injury by electric current a grounding loop is provided around the bus. In the case of an accidental hit of network voltage on the housing of the equipment vehicle an automatic disconnect of power supply voltage is provided with the layout.

Two modifications of parabolic antennas with a diameter of 1 and 1.5 m are used in the retransmitter. A reflector with a diameter of 1 m is used on the antenna-mast device. This is conditioned by the fact that it has a wind resistance area which is 2.25 times less than a sesquimetric reflector, and the radiation pattern is twice as wide. A reflector with a diameter of 1.5 m is used when operating from the roofs of buildings or the equipment vehicle. The focal distance for both reflectors is the same and is equal to 500 mm.

For connecting the antenna head of the retransmitter with the equipment vehicle a special combination cable developed by the NII of the cable industry is used, and also a special combination plug and socket unit, developed in particular for the new radio links. The cable has three coaxials and 34 service conductors.

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